Machine Learning and Data Science

Evaluation de la performance des modèles de régression

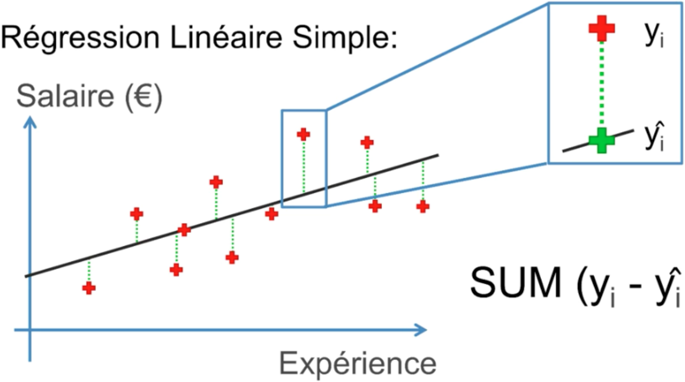
Bassem Ben Hamed

Juillet 2018

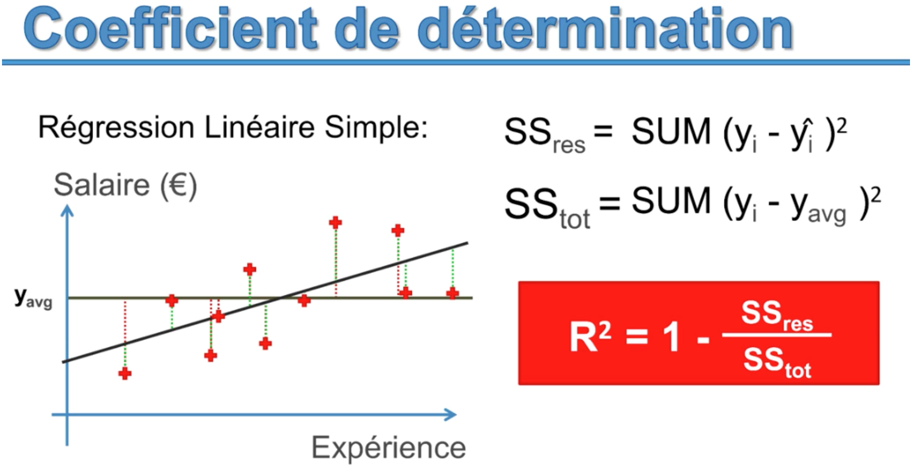
Coefficient de détermination R^2

Coefficient de détermination

Régression Linéaire Simple:



$$\text{SUM } (y_i - \hat{y}_i)^2 \text{ -> min}$$



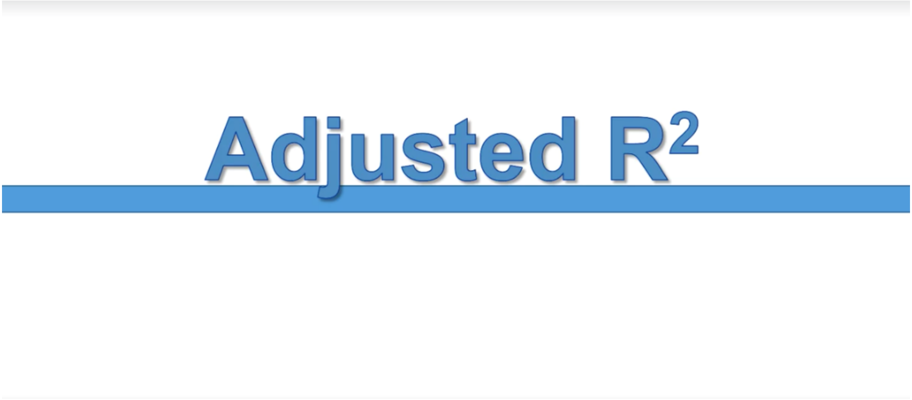
Coefficient de détermination

Régression Linéaire Simple:

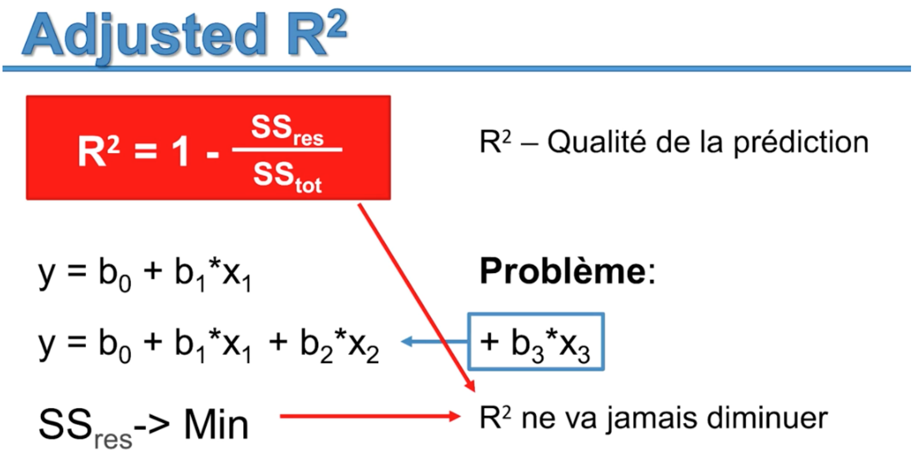
$$SS_{res} = \text{SUM}\,(y_i - \hat{y}_i)^2$$

$$SS_{tot} = \text{SUM}\,(y_i - y_{avg})^2$$

$$\boxed{R^2 = 1 - \frac{SS_{res}}{SS_{tot}}}$$



Adjusted R^2



Adjusted R²

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}}$$

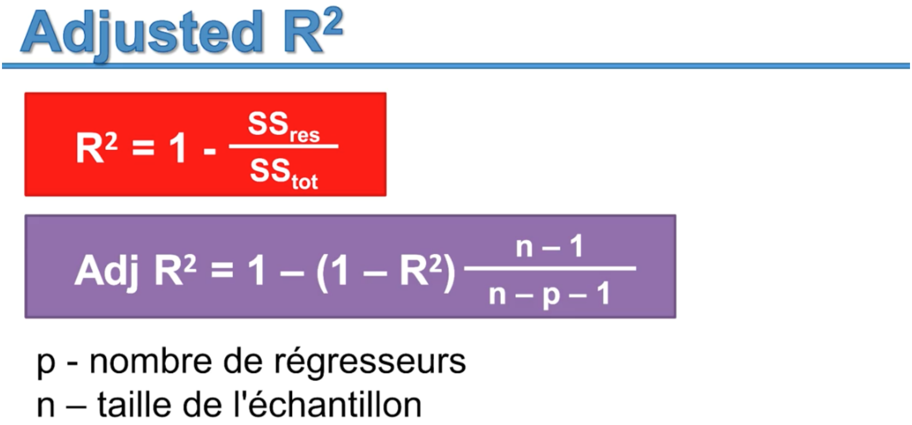
R² – Qualité de la prédiction

$y = b_0 + b_1{*}x_1$

Problème:

$y = b_0 + b_1{*}x_1 + b_2{*}x_2 \leftarrow \boxed{+\, b_3{*}x_3}$

SS_{res}-> Min → R² ne va jamais diminuer



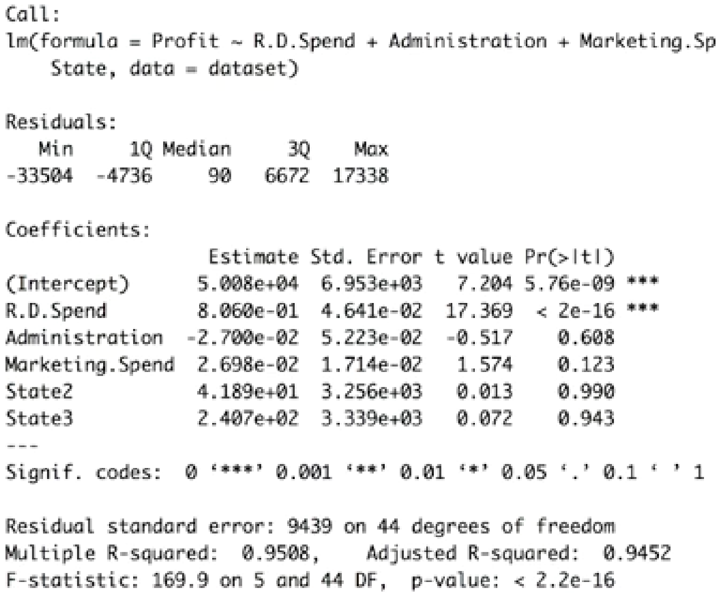
Adjusted R^2

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}}$$

$$\text{Adj } R^2 = 1 - (1 - R^2)\frac{n - 1}{n - p - 1}$$

p - nombre de régresseurs

n – taille de l'échantillon

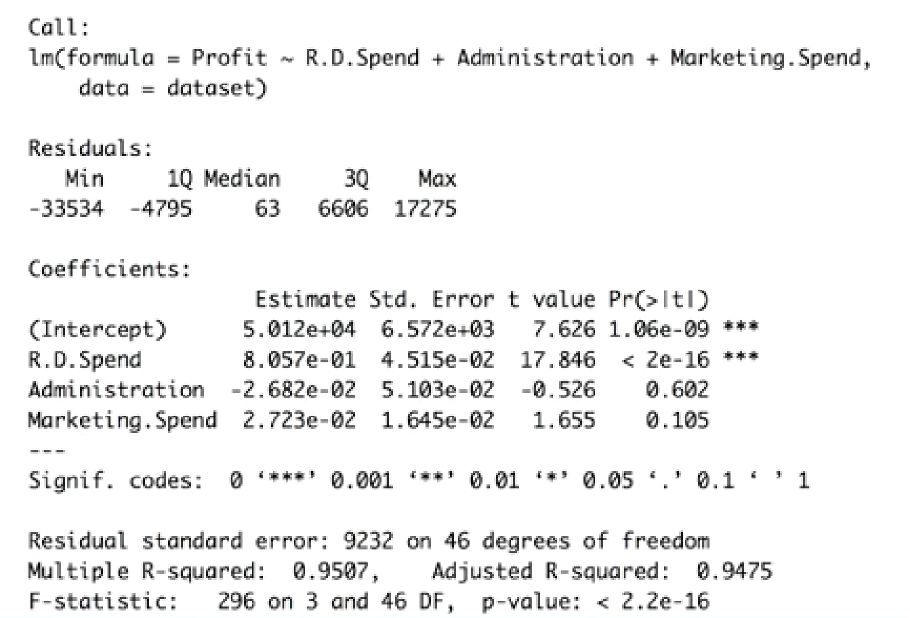


```
Call:
lm(formula = Profit ~ R.D.Spend + Administration + Marketing.Spend +
    State, data = dataset)

Residuals:
   Min     1Q Median     3Q    Max
-33504  -4736     90   6672  17338

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)      5.008e+04  6.953e+03   7.204 5.76e-09 ***
R.D.Spend        8.060e-01  4.641e-02  17.369  < 2e-16 ***
Administration  -2.700e-02  5.223e-02  -0.517    0.608
Marketing.Spend  2.698e-02  1.714e-02   1.574    0.123
State2           4.189e+01  3.256e+03   0.013    0.990
State3           2.407e+02  3.339e+03   0.072    0.943
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9439 on 44 degrees of freedom
Multiple R-squared:  0.9508,	Adjusted R-squared:  0.9452
F-statistic: 169.9 on 5 and 44 DF,  p-value: < 2.2e-16
```

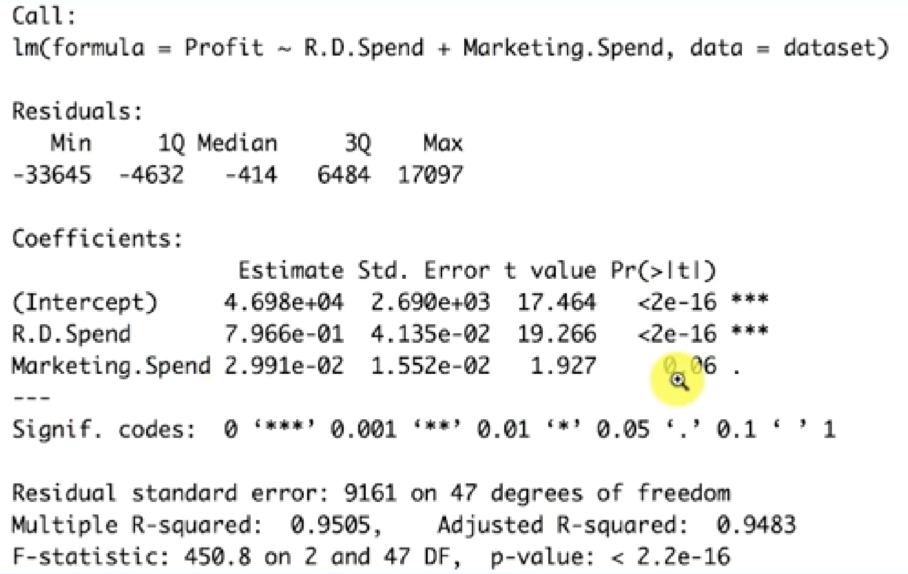


```
Call:
lm(formula = Profit ~ R.D.Spend + Administration + Marketing.Spend,
    data = dataset)

Residuals:
   Min     1Q Median     3Q    Max 
-33534  -4795     63   6606  17275 

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)    
(Intercept)      5.012e+04  6.572e+03   7.626 1.06e-09 ***
R.D.Spend        8.057e-01  4.515e-02  17.846  < 2e-16 ***
Administration  -2.682e-02  5.103e-02  -0.526    0.602    
Marketing.Spend  2.723e-02  1.645e-02   1.655    0.105    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9232 on 46 degrees of freedom
Multiple R-squared:  0.9507,	Adjusted R-squared:  0.9475 
F-statistic:   296 on 3 and 46 DF,  p-value: < 2.2e-16
```

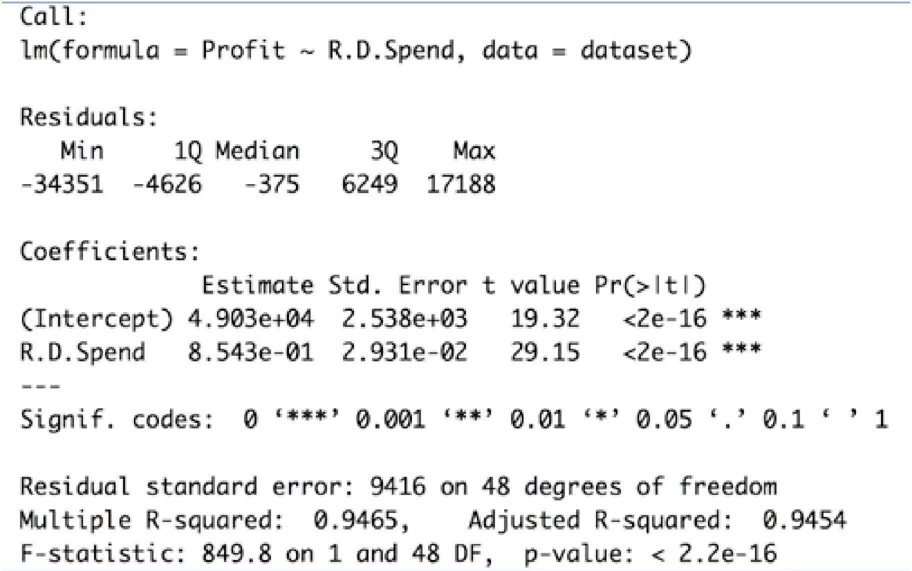


```
Call:
lm(formula = Profit ~ R.D.Spend + Marketing.Spend, data = dataset)

Residuals:
   Min     1Q Median     3Q    Max 
-33645  -4632   -414   6484  17097 

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)    
(Intercept)     4.698e+04  2.690e+03  17.464   <2e-16 ***
R.D.Spend       7.966e-01  4.135e-02  19.266   <2e-16 ***
Marketing.Spend 2.991e-02  1.552e-02   1.927     0.06 .  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9161 on 47 degrees of freedom
Multiple R-squared:  0.9505,	Adjusted R-squared:  0.9483 
F-statistic: 450.8 on 2 and 47 DF,  p-value: < 2.2e-16
```



```
Call:
lm(formula = Profit ~ R.D.Spend, data = dataset)

Residuals:
   Min     1Q Median     3Q    Max 
-34351  -4626   -375   6249  17188 

Coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept) 4.903e+04  2.538e+03   19.32   <2e-16 ***
R.D.Spend   8.543e-01  2.931e-02   29.15   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9416 on 48 degrees of freedom
Multiple R-squared:  0.9465,	Adjusted R-squared:  0.9454 
F-statistic: 849.8 on 1 and 48 DF,  p-value: < 2.2e-16
```